



Initiation of Long-term Wetland Monitoring in the Delaware Estuary

Image USDA Farm Service Agency
Google Earth
39° 52' 52.86" N 75° 00' 00.99" W Elev: 0 ft
Eye Alt: 16342 ft

February 29, 2012

T. Elsey-Quirk, D.J. Velinsky, D.A. Kreeger, M. Maxwell-Doyle, A. Padeletti



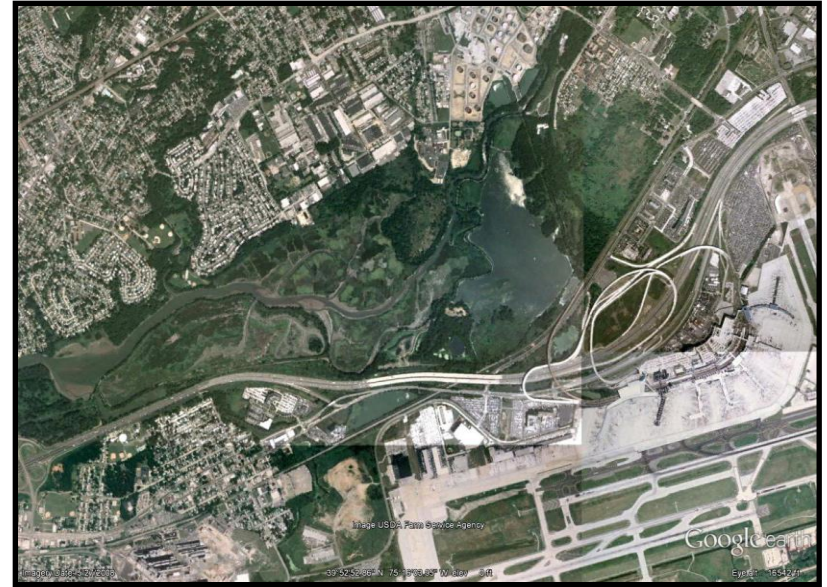
Wetland Services and Functions

- **Protection from storm surge and coastal flooding**
- **Habitat for fish and wildlife**
- **Nutrient transformation and removal**
- **Carbon storage ($210 \text{ g C m}^{-2} \text{ yr}^{-1}$)**

Causes for concern

1. ALTERED LANDSCAPE

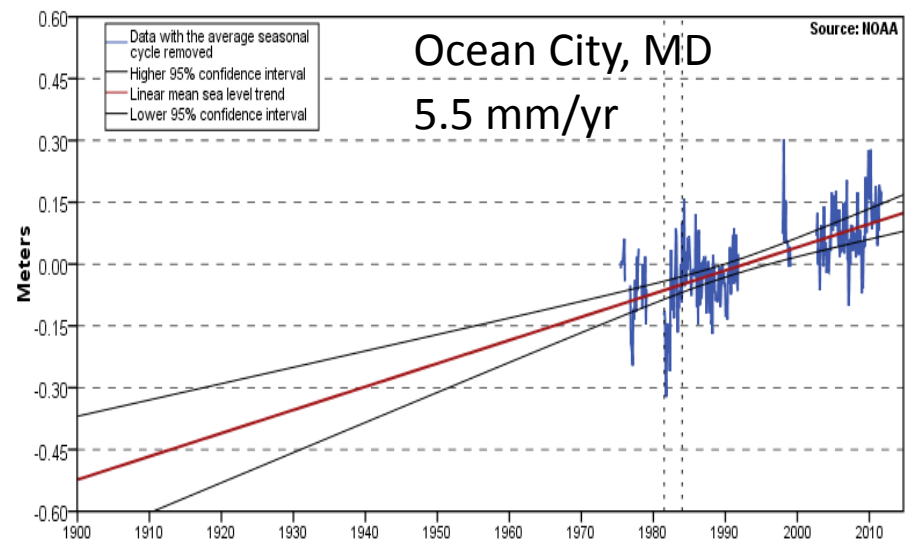
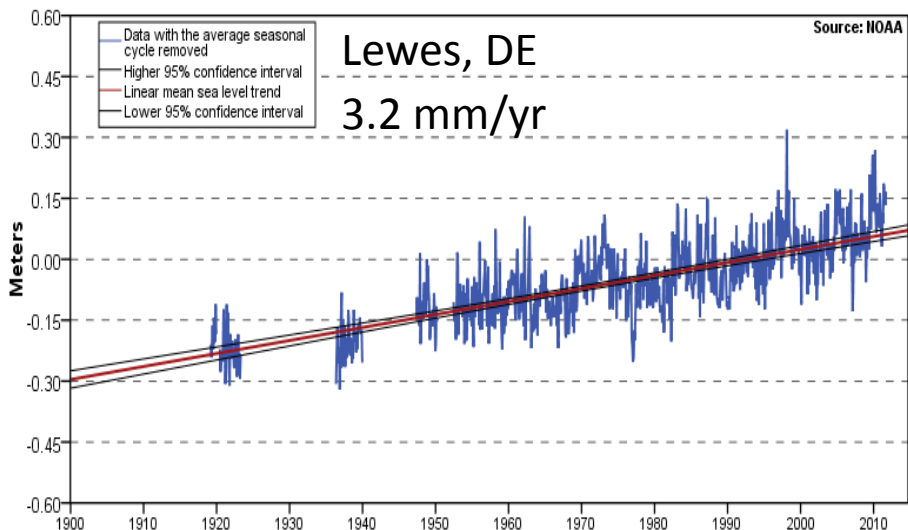
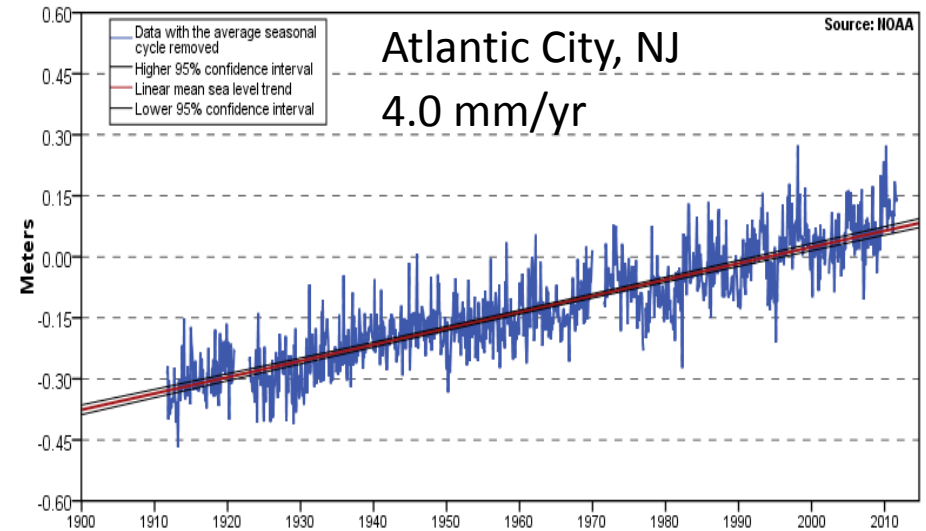
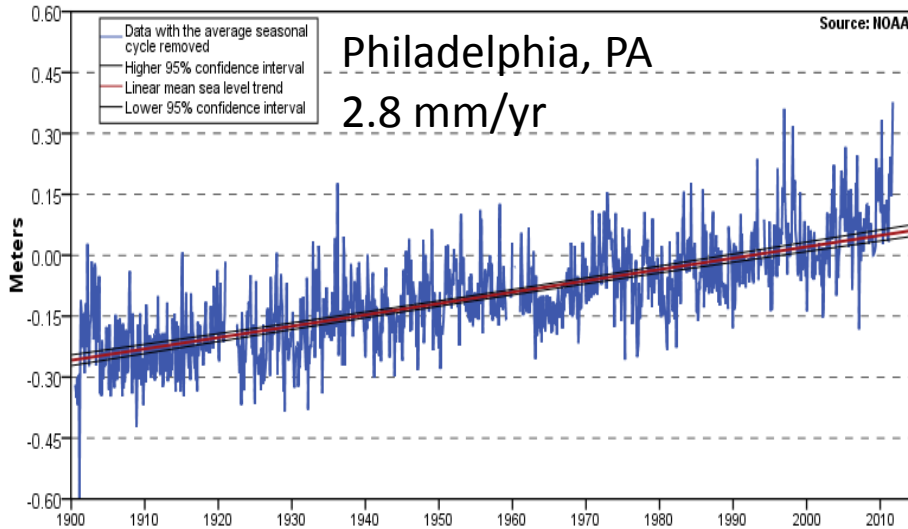
- Coastal development
- Groundwater withdrawal
- Altered sediment load
- Increased nutrient load
- Direct human alterations



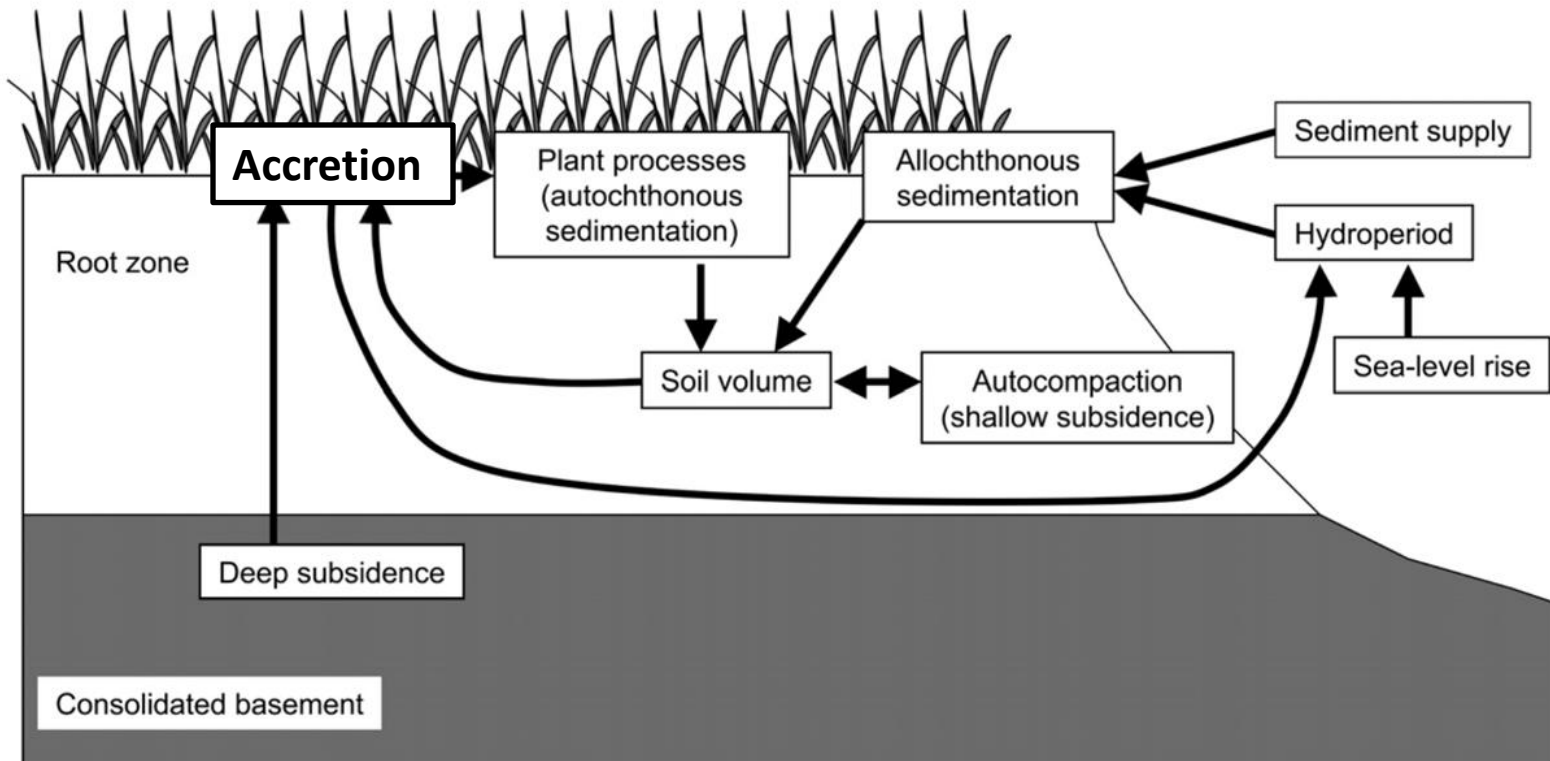
2. RELATIVE SEA LEVEL RISE



Tide gauges show a regional increase in relative sea level

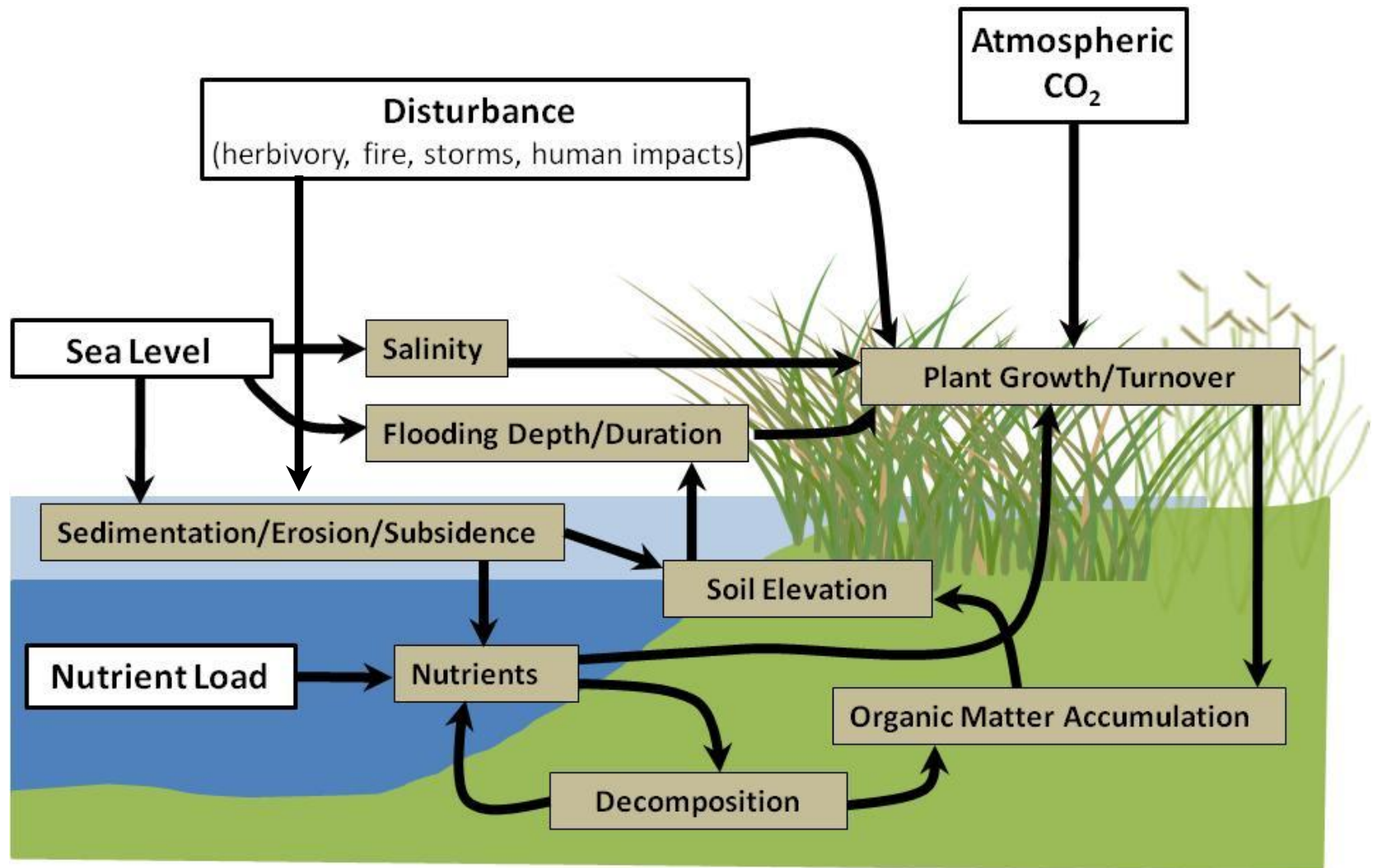


Wetland accretion

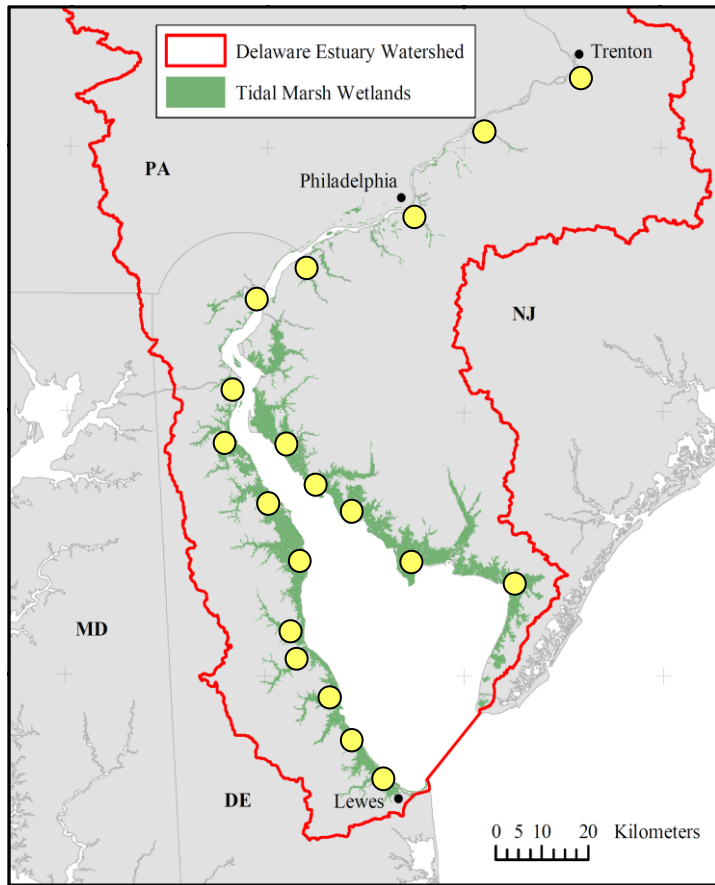


- Local accretion = mass accumulation ÷ soil bulk density
 $\text{cm/y} \quad \text{g/cm}^2/\text{y} \quad \text{g/cm}^3$
- Absolute accretion = local accretion + subsidence

Processes Influencing Wetland Accretion



Accretion rates in Delaware



- Push-piston coring
- Density & LOI analysis
- ^{210}Pb & ^{137}Cs dating
- Rate computation



Along-estuary marsh accretion rates

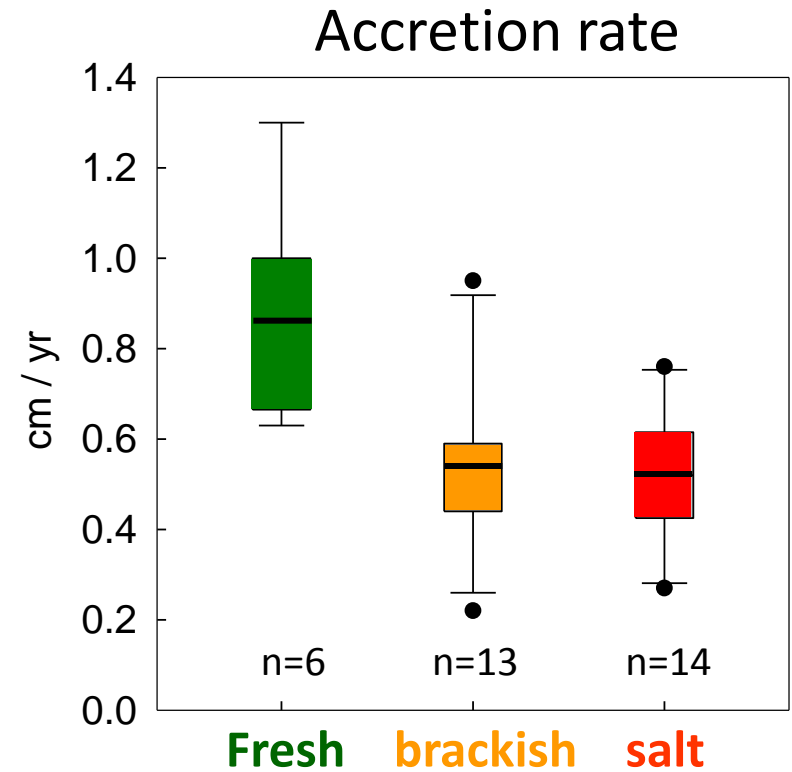
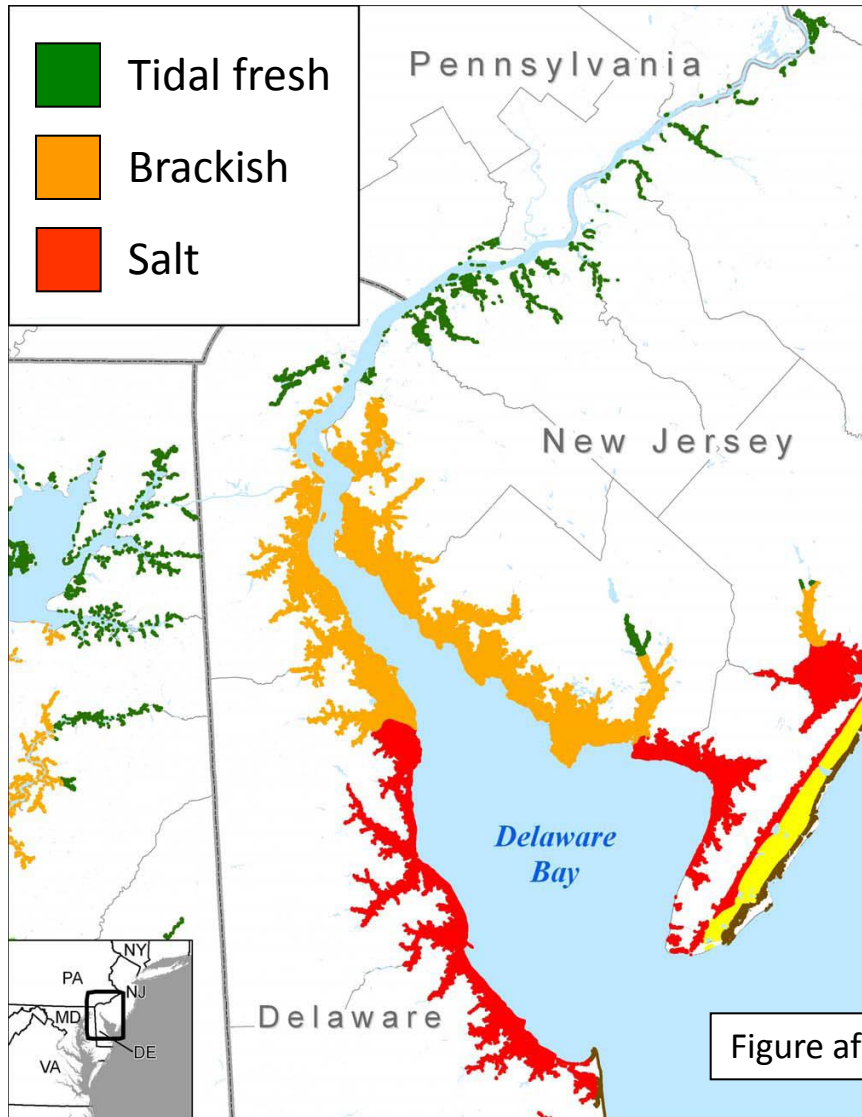
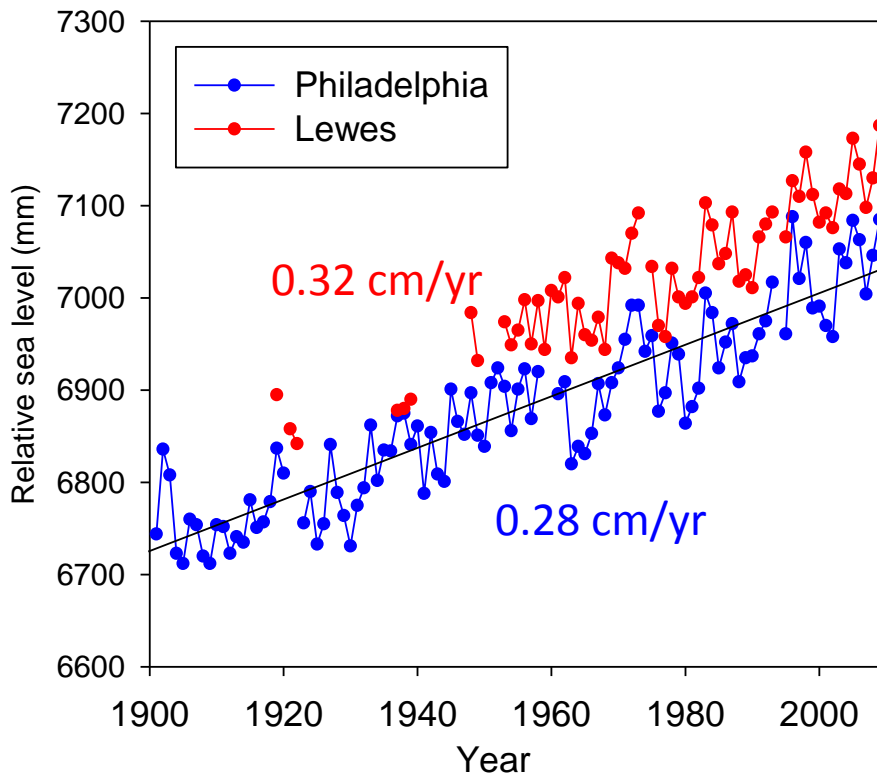


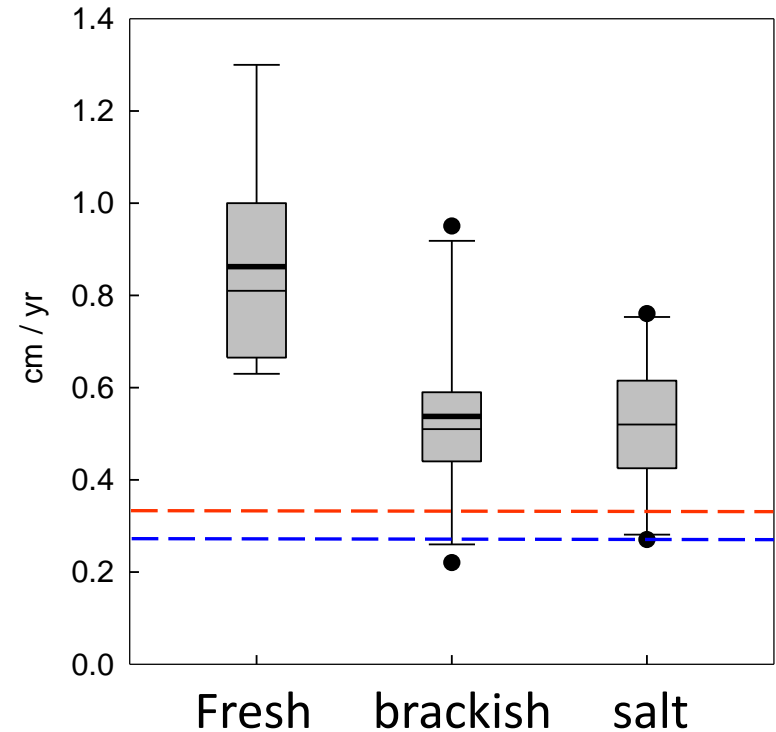
Figure after Titus et al. (2008)

Marsh accretion vs. relative sea-level rise

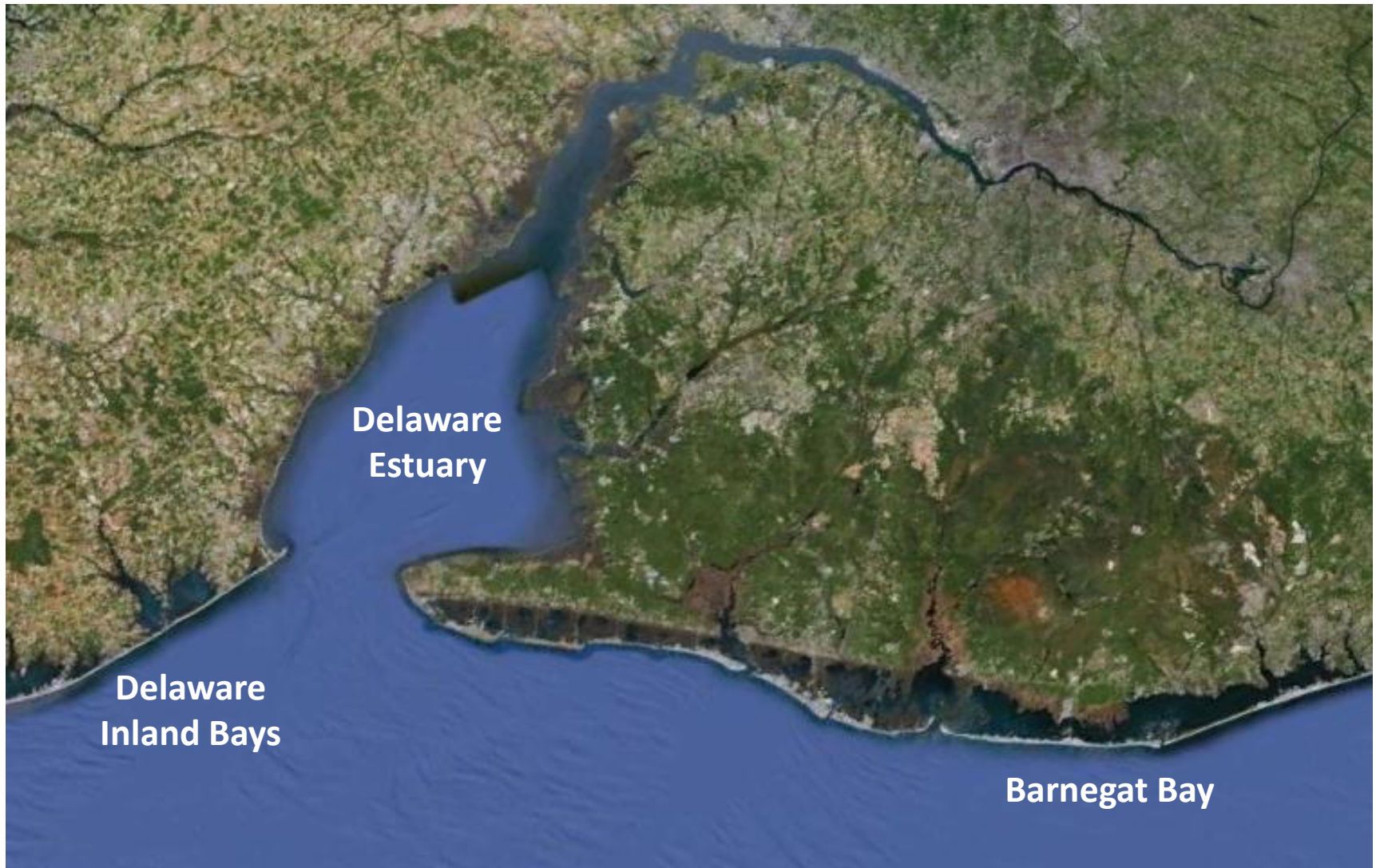
NOAA sea level from tide gauges



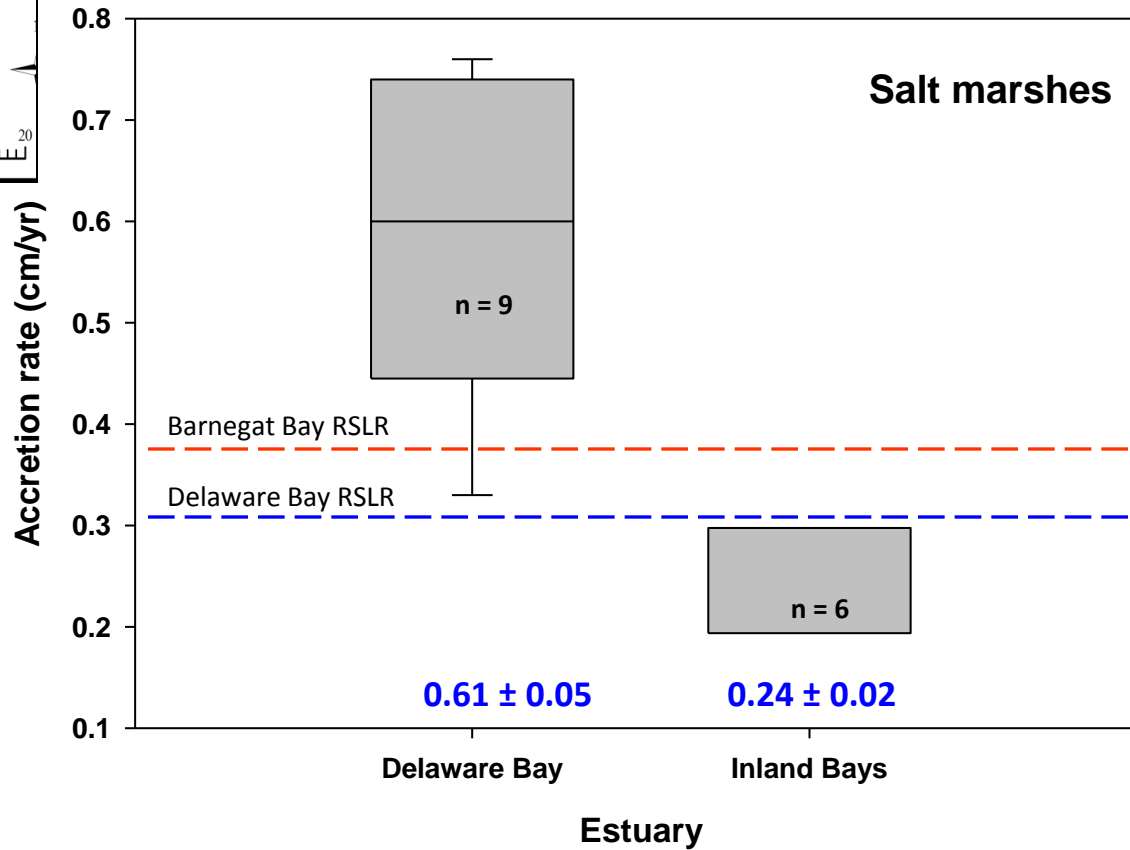
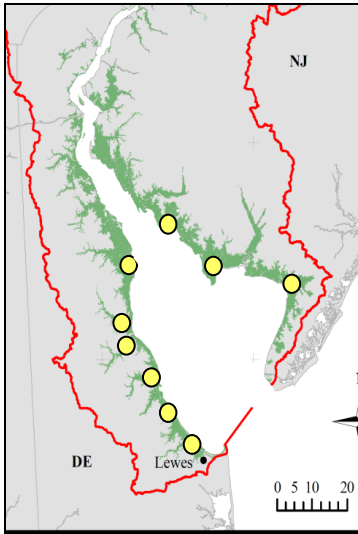
Delaware Bay Accretion rates



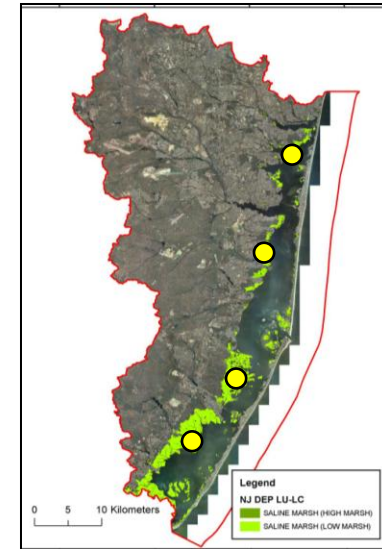
Variation regionally among estuaries?



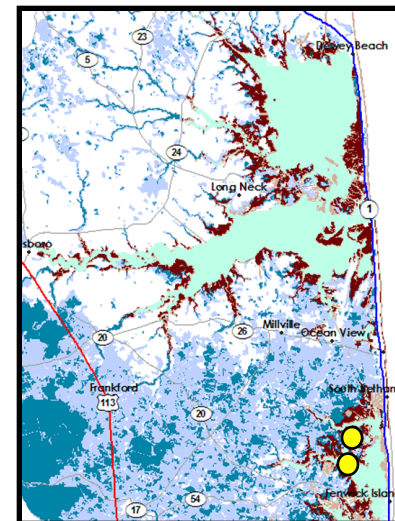
Delaware Bay



Barnegat Bay



DE Inland Bays



Wetlands designated as a long-term monitoring sites

Mid-Atlantic Coastal Wetlands Assessment (MACWA)

MACWA Partners

Partnership for Delaware Estuary

Barnegat Bay Partnership

ANSP

DNREC

US Fish and Wildlife Refuges

Rutgers University



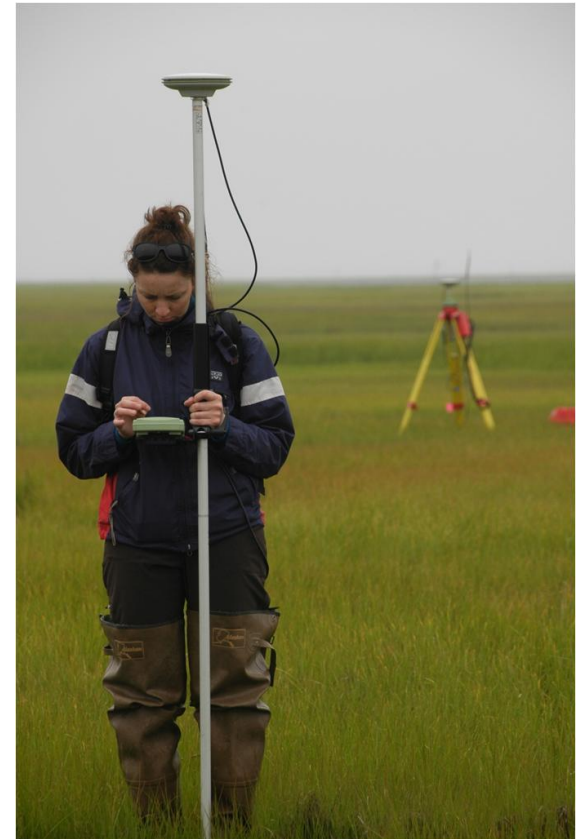
Monitoring activities

Surface elevation changes

Plant production

Soil chemistry

Water quality



EPA 3-Tiered Framework for Wetland Monitoring and Assessment

Level 1	Landscape assessment	GIS data (e.g., % forest cover, land use)
Level 2	Rapid assessment	Simple metrics of wetland condition
Level 3	Intensive site assessment	Direct and detailed measurement of biological taxa and hydrogeomorphic function
Level 4	Site-specific intensive monitoring	Repeated measurements of physical, chemical and biological metrics

Central questions:

Are wetlands keeping up with sea level rise?

Is there spatial and temporal variation in wetland structure and function over time?

1. Are plant zones and morphology changing over time?
2. Are elevations and topography changing over time?
3. Is plant productivity above- and belowground changing and how does it contribute to accretion?
4. How does water and soil quality relate to accretion and change over time?
5. Is there a change in faunal abundance over time?

MACWA SSIM

GOAL

Develop effective and feasible hypothesis-driven long-term monitoring of condition of representative wetlands along the Delaware Estuary and Barnegat Bay.

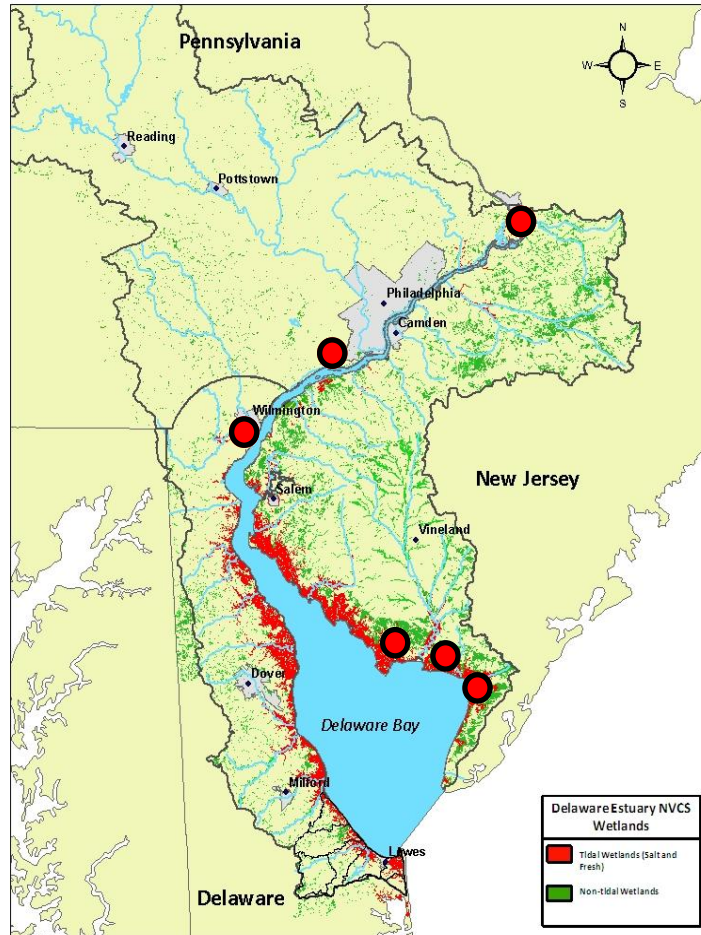
Monitoring Objectives

- Surface elevation (SETs, MHs, and RTK GPS)
- Plant zones, cover, ht over time (LT, Elevations, Quads)
- Plant biomass (above-below biomass)
- Algal biomass (soil surface chl a)
- Soil chemistry (soil cores – C, N, and P)
- Water quality (YSI spot measurements, creek water collection – NO₃, NH₄, ALK, TSS)
- Faunal Integrity

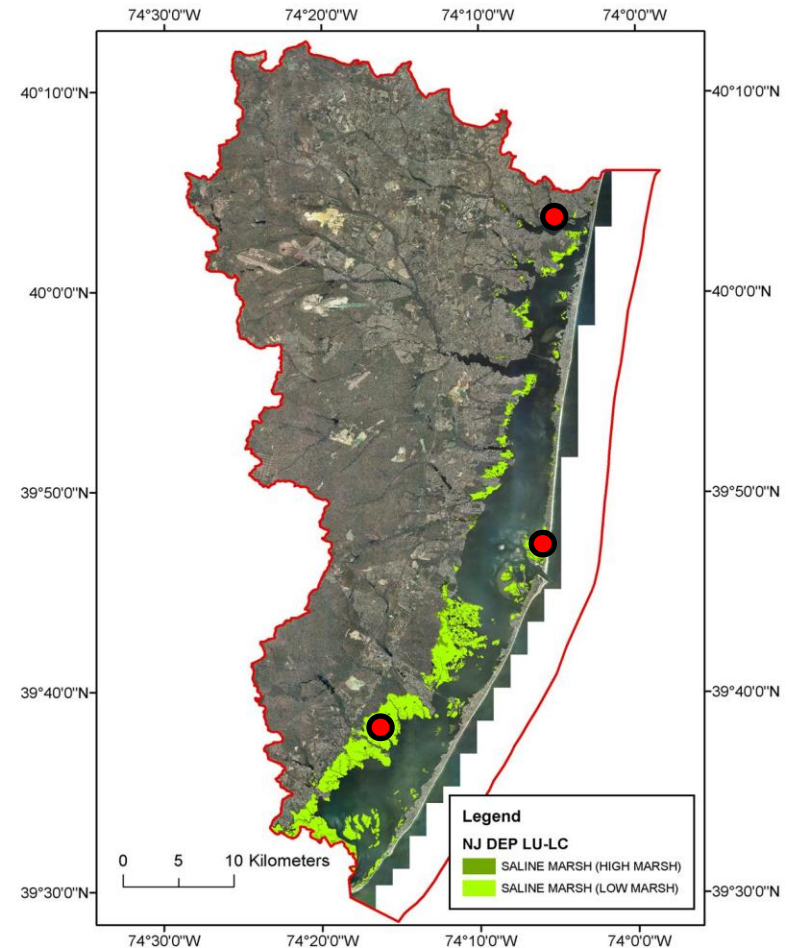
Wetland Monitoring Locations

Delaware Bay

NVCS - Tidal and Non-tidal systems of the lower Delaware Estuary



Barneget Bay, New Jersey



Are wetlands keeping up with sea level rise?

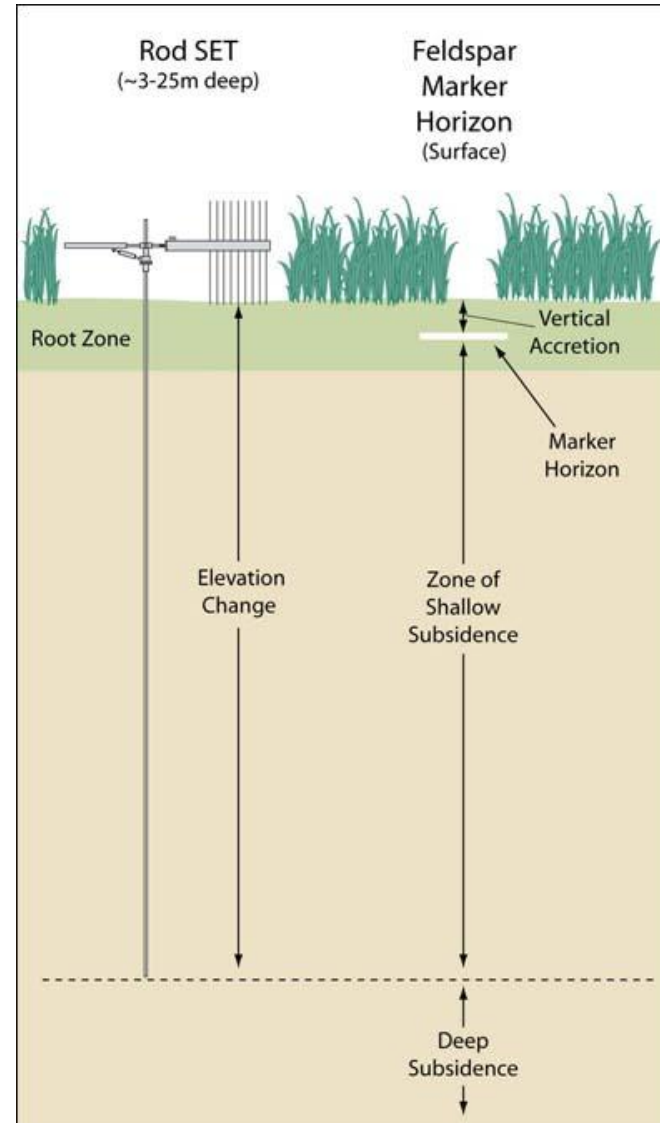
Surface elevation table

Measures elevation change from the bottom of the benchmark pipe

Paired with marker horizons to measure root zone surface accretion

Need replication ($n = 3$)

Transect design will give variation within a wetland given different distances from sediment source (estuary or tidal creek)



Conceptual SET array

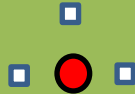
Increasing distance



SET 3



SET 2



SET 1



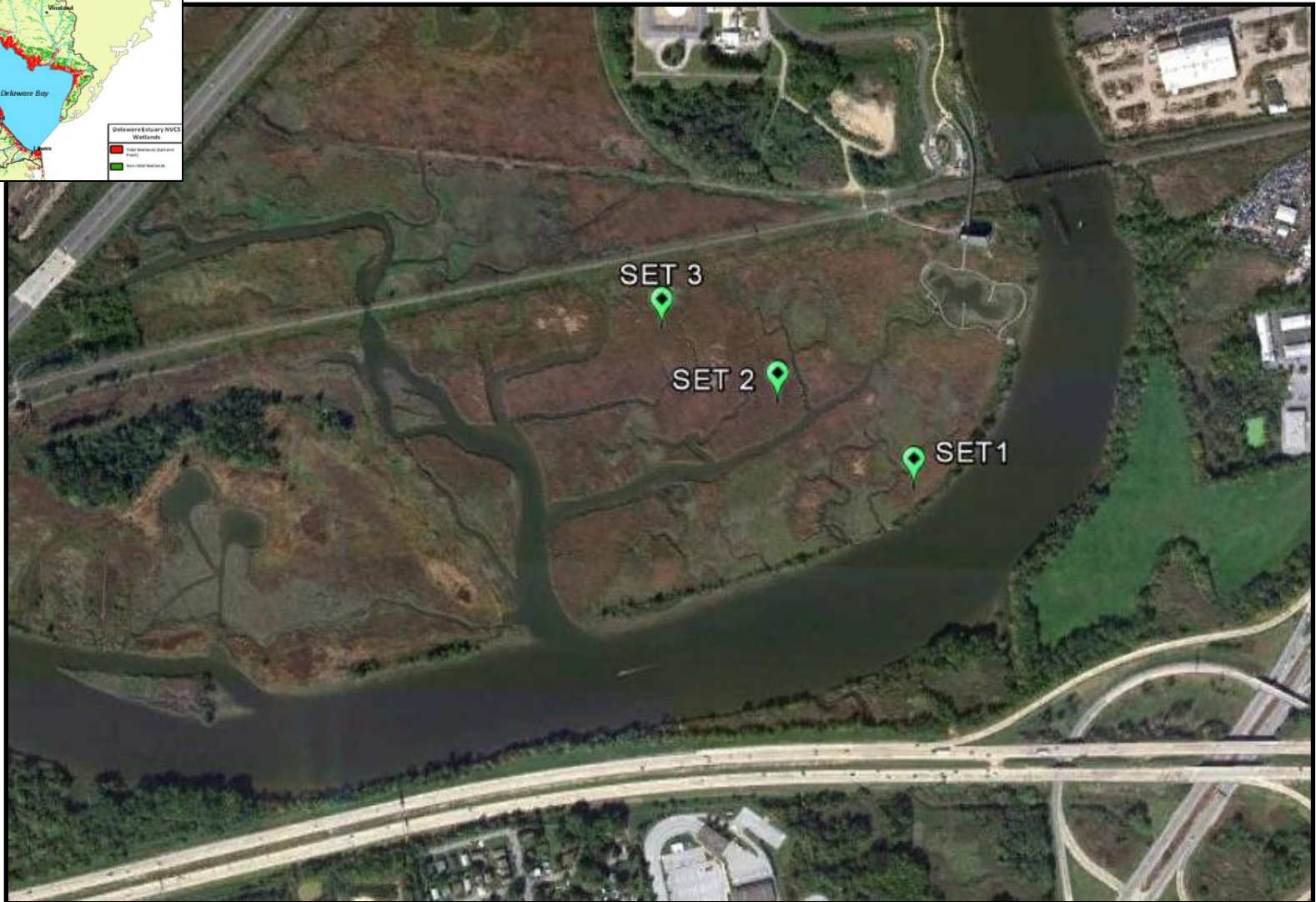
Estuary (sediment source)

SET
MH



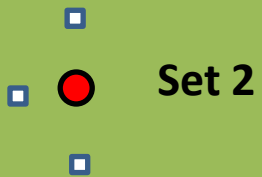
Christina River- Delaware Bay

Tidal fresh water wetland



Conceptual SET array

Increasing distance



Estuary (sediment source)

Dennis Creek – Delaware Bay Salt marsh



SET Installation



2010 – 2011

3 SETs installed in each site
9 wetland sites



SET Measurement and MHs

Lower SET pins for measurement



Feldspar marker horizons



Elevation

1. Relative elevation of each SET benchmark

- use barcode level



2. Elevation relative to a geodetic control point

- barcode level from SET benchmark to a geodetic control point

Plant community and elevation survey



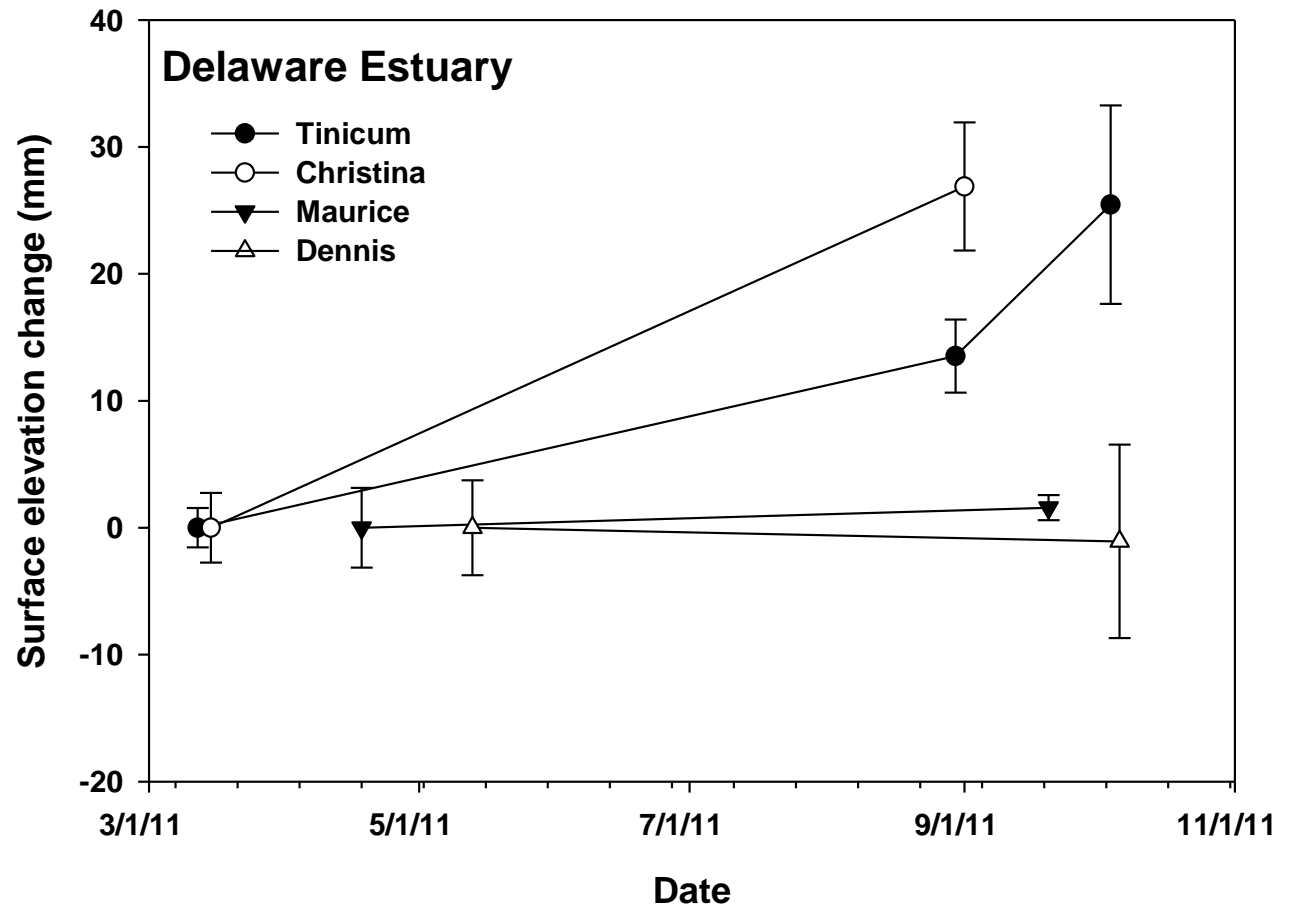
Biomass and fauna



Water and soil nutrients



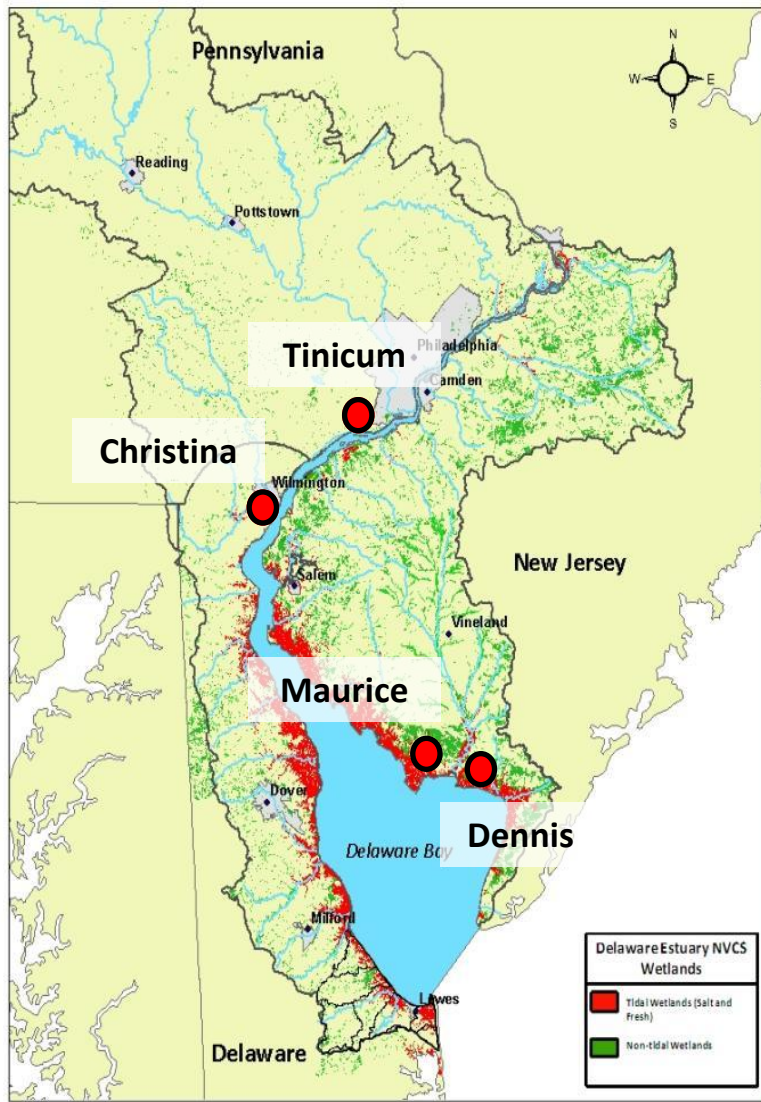
Initial SET data



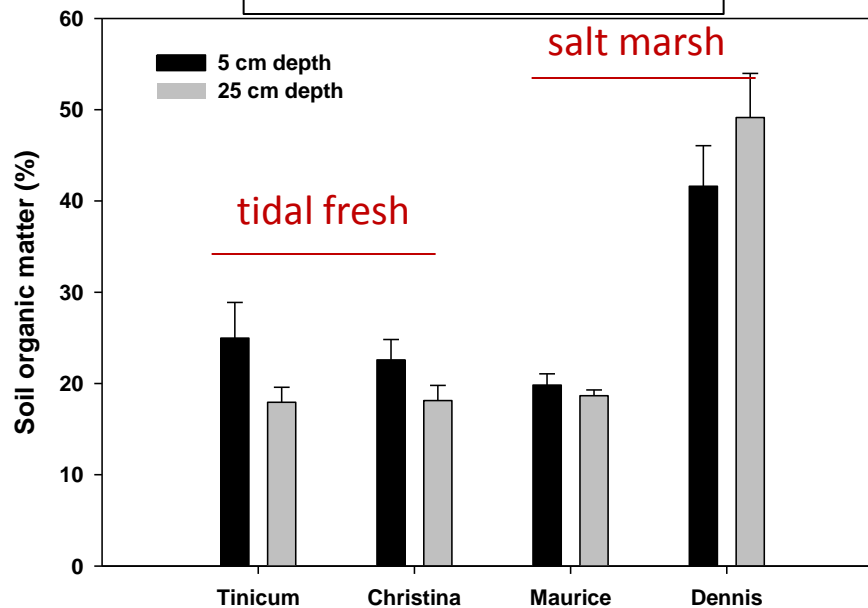
Need ~4 years of data to see a real trend (salt marshes)!

INITIAL POINTS FOR LONG-TERM DATA

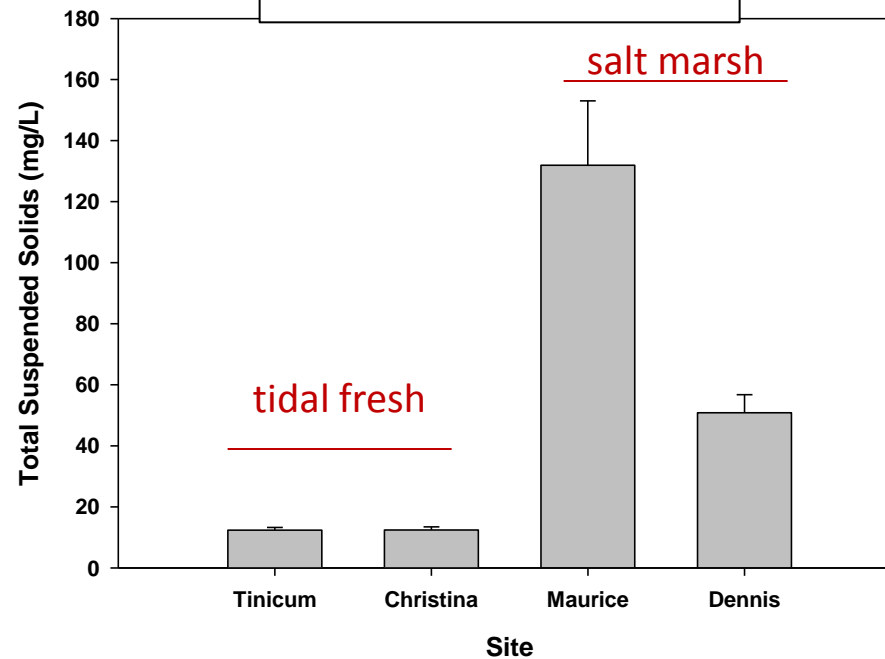
NVCS - Tidal and Non-tidal systems of the lower Delaware Estuary



Soil Organic Matter



Water Column Solids

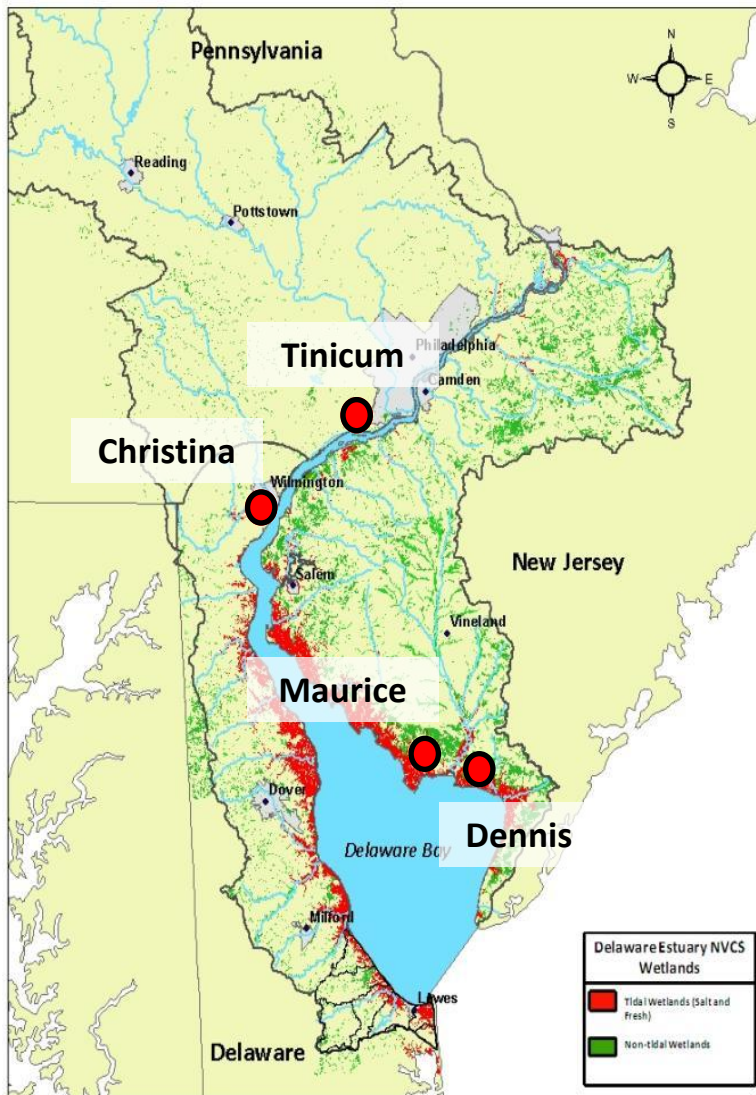


Hypothesis

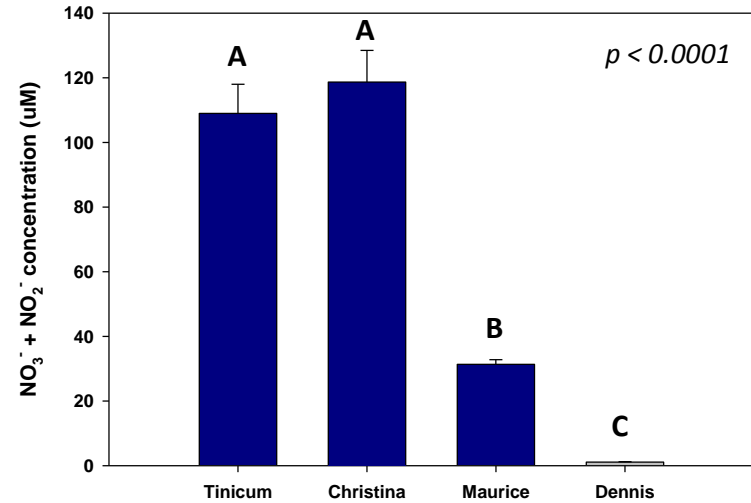
1. High sedimentation rates causing a dilution effect on SOM concentration in Maurice River salt marshes

Tidal Creek Nutrients

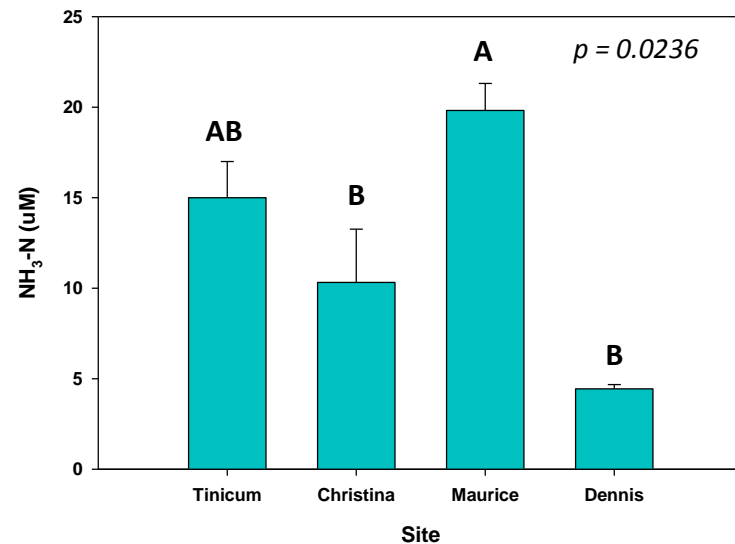
NVCS - Tidal and Non-tidal systems of the lower Delaware Estuary



Nitrate + Nitrite



Ammonium



Hypothesis

1. High sedimentation rates causing a dilution effect on SOM concentration in Maurice River salt marshes
2. High nutrient concentrations affecting the production and/or decomposition of SOM
3. Both

Year 1 Conclusions

- 9 sites were established in DB and BB
- Year 1 of SSIM illustrates spatial variation and potential relationships
- Future years of data collection will allow to examine temporal variation in parameters